Organic and inorganic carbon fluxes in a tropical river system (Tana River, Kenya) during contrasting wet seasons

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Introduction

➢ The majority of discharge in tropical river systems occurs in relatively short time periods. E.g. in Tana River, ~60% of the annual discharge in 4 months.

➢ This seasonality has effect on the carbon (C) transport as C processes, such as respiration and primary production vary with discharge.

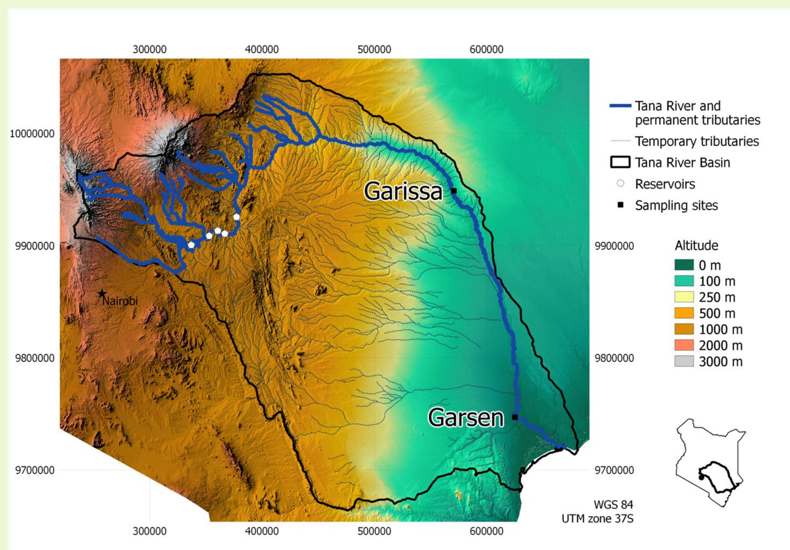
➢ Furthermore, connection with the floodplain during flooding significantly alters the biogeochemical functioning.

***Research question*: What is the role of floodplains on delivery or retention of C to the main channel?**

Study area and methods

➢ 2 sampling sites: Garissa and Garsen, situated 385 km apart in the lower Tana River, Kenya

➢ Daily samples to measure the concentration of particulate and dissolved organic carbon (POC and DOC) and dissolved inorganic carbon (DIC) *.



➢ 3 sampling campaigns: Oct-Nov 2012, May-June 2013 and April-May 2014.

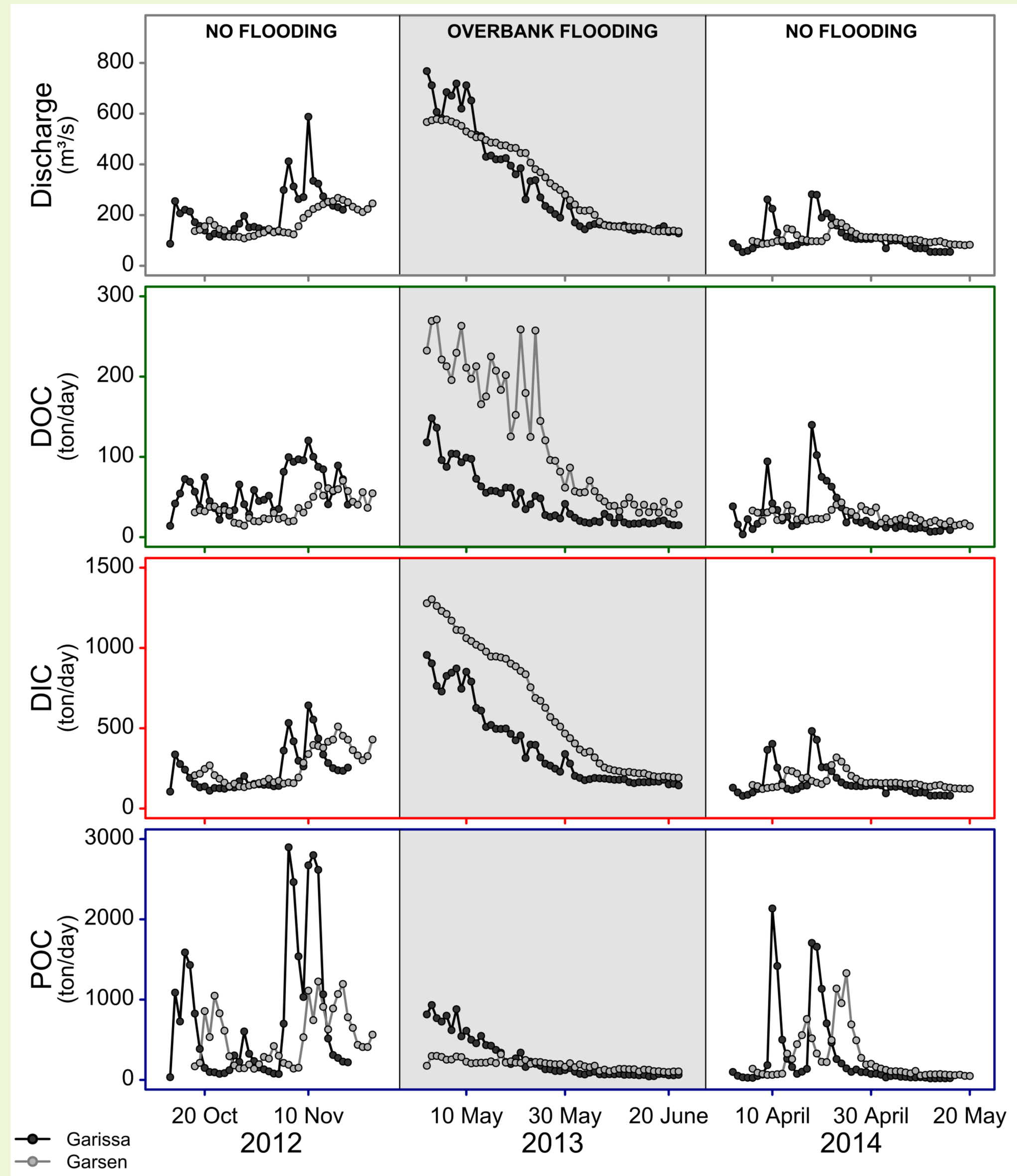
➢ In 2013, considerable overbank flooding took place between the sampling sites. No significant flooding occured in the other wet seasons.

➢ Carbon loads were calculated by multiplying water discharge and carbon concentration. Missing values were interpolated based on the flux-discharge relationship. Seasonal fluxes are the sum of the loads.

* **POC**: 25 ml of water filtered on 25 mm Whatman GF/F filters. Concentration measured on EA-IRMS (ThermoFinnigan Flash HT). **DOC**: 40 ml of water filtered on 0.2 µm Acrodisc syringe filters, preserved with H_3PO_4. Analysed on a wet oxidation TOC-analyzer (IO Analytical Aurora 1030W) coupled with an IRMS (ThermoFinnigan DeltaV Advantage). **DIC**: calculated from TA (automated electro-titration) and pCO2 (headspace technique on LI-820 gas analyzer) with thermodynamic constants from Millero.

Results

Carbon loads

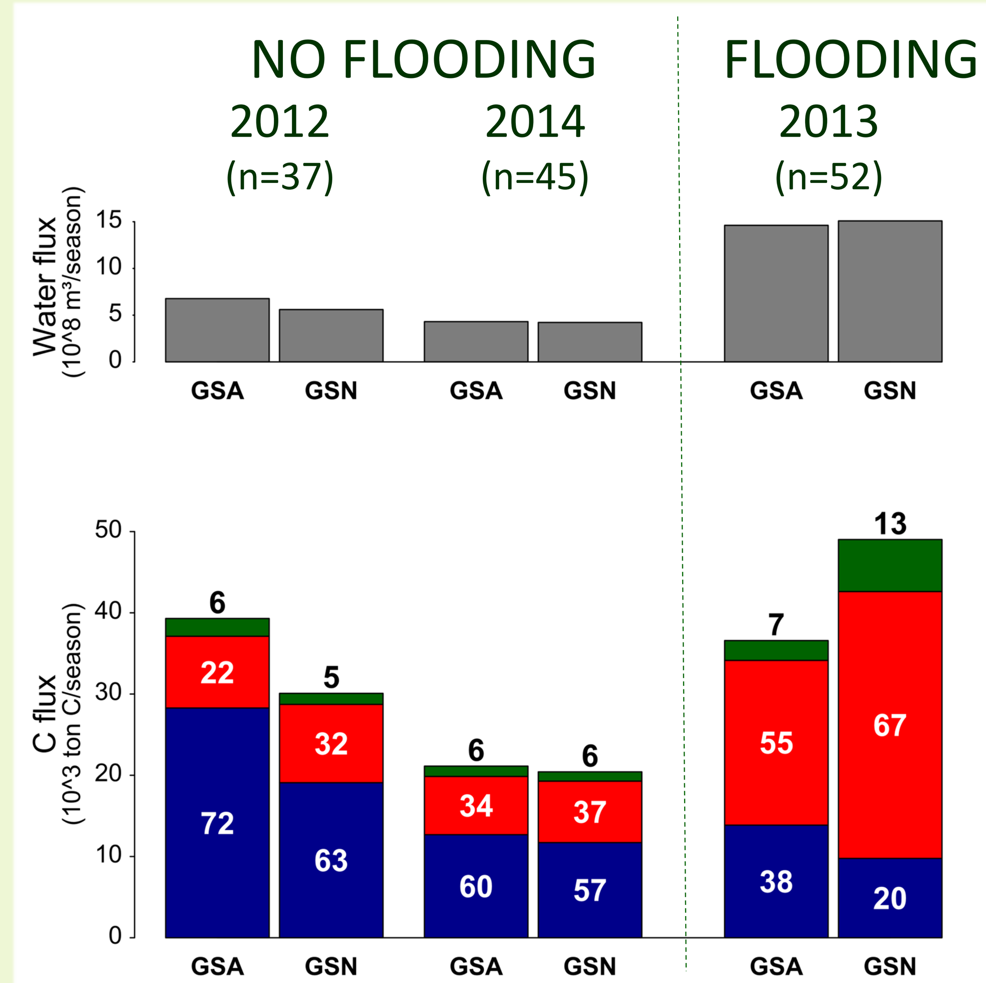


➢Highest DOC and DIC loads during peaks with flooding

➢Highest POC loads during peaks without flooding

➢At low discharge, daily loads increase in the downstream direction for all C pools (end of 2014)

Seasonal fluxes



Water
POC
DIC
DOC

GSA: Garissa
GSN: Garsen

Numbers in the bars are percentage share of the carbon pool per site and per season

➢ Downstream decrease in water and total C flux during non-flooded seasons; Downstream increase in water and total C flux during the flooded season

➢POC flux decreased downstream (33%, 8% and 30% in 2012, 2014 and 2013)

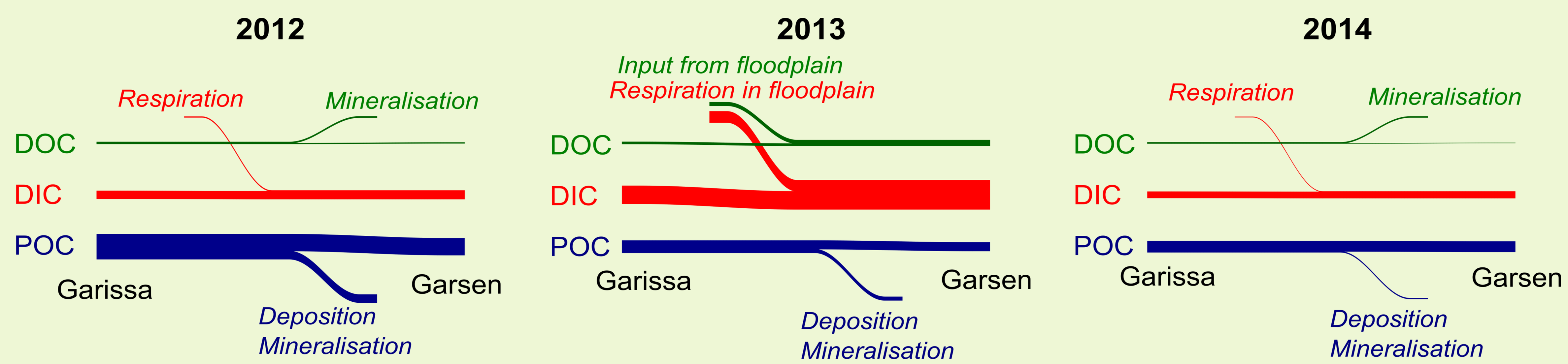
➢DIC flux increased downstream (9%, 6% and 62% in 2012, 2014 and 2013)

➢ DOC flux decreased during non-flooded seasons (38% and 10% in 2012 and 2014), and increased by 163% in the flooded season (2013)

➢POC was the dominant C pool during the non-flooded season; DIC was the dominant pool during the flooded season

Conclusion

Related to changes in the dominant carbon pool, the floodplains between both sites are a source of C towards the river during the flooded season and a sink of riverine C during the non-flooded seasons.



Notes

➢ The calculated loss/gain of C are net fluxes between the two sites. Fluxes between the different pools are not yet taken into account.

➢ The fluxes are only valid for the observation periods and can not be directly extrapolated to the whole season or year.

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